AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111

Serial Number: 09/964,586 Filing Date: September 28, 2001

Title: PACKAGE STIFFENER (As Amended)

Assignee: Intel Corporation

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## **IN THE CLAIMS**

Please amend the claims as follows:

- 1. (Currently Amended) An integrated circuit (IC) package comprising:

  one of a thin-core substrate and a coreless substrate supporting at least a die; and
  a package stiffener mounted at a perimeter of the substrate, and arranged apart from the
  die on the substrate to deliver low-inductance current to the die, via the substrate, while
  concurrently providing stiffening support to the substrate.
- 2. (Currently Amended) An IC package as claimed in claim 1, wherein the package stiffener includes a copper [[(Cu)]] ring split into power and ground portions, and insulating couplers electrically isolating the power and ground portions of the split copper [[(Cu)]] ring.
- 3. (Currently Amended) An IC package as claimed in claim 2, wherein the split copper [[(Cu)]] ring mounts on the substrate[[,]] via a solder with a low resistance path to deliver large amounts of current to the substrate and remove heat from the substrate.
- 4. (Currently Amended) An IC package as claimed in claim 1, wherein the substrate comprises includes one of a thick-core, a thin-core, and a coreless substrate in one of a ceramic, a flex, and an integrated circuit printed circuit board (IC-PCB) carrier package.
- 5. (Currently Amended) An IC package as claimed in claim 4, further comprising [[being]] one of a pinned grid array (PGA), and a ball grid array (BGA) carrier package.
- 6. (Currently Amended) An IC package as claimed in claim 4, further comprising [[being]] one of a flip chip pin grid array (FC-PGA), and a flip chip ball grid array (FC-BGA) carrier package.

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7. (Previously Presented) An IC package as claimed in claim 1, wherein the package stiffener includes one of electrically conductive, insulating, and intermingled electrically conductive and insulating sections, and one of a molded, stamped, etched, extruded and deposited frame, wherein the stiffener is to withstand temperatures of at least normal IC operation.

- 8. (Currently Amended) An IC package as claimed in claim 2, further comprising a heat spreader plate bonded to the split copper [[(Cu)]] ring by epoxy and to the die by thermal interface material.
- 9. (Previously Presented) An IC package as claimed in claim 1, wherein the package stiffener is to support at least partially a heat sink.

Claims 10-62. (Canceled)

63. (Currently Amended) An integrated circuit (IC) package comprising:

one of a thin-core substrate and a coreless substrate having a die-side, wherein a die is disposed upon the die-side of the substrate; and

<u>a frame</u> a power/ground/impedance deliverer (PGID) disposed upon the die-side of the substrate, and spaced from the die to deliver low-inductance current to the die, via the substrate, while concurrently providing stiffening support to the substrate.

- 64. (Canceled)
- 65. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the <u>frame</u> [[PGID]] extends along at least two side edges of the substrate.
- 66. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the <u>frame</u> [[PGID]] is positioned at two separate sections on the substrate.

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67. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the <u>frame</u> [[PGID]] is positioned at separate corner edges of the substrate.

- 68. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the frame [[PGID]] includes a ring that extends along the perimeter of the substrate.
- 69. (Currently Amended) An integrated circuit (IC) package as claimed in claim 68 wherein the <u>frame</u> [[PGID]] has rounded corners.
- 70. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the <u>frame</u> [[PGID]] and the substrate have similar coefficients of thermal expansion.
- 71. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the <u>frame</u> [[PGID]] has a ground side portion and a power side portion.
- 72. (Previously Presented) An integrated circuit (IC) package as claimed in claim 71 wherein the ground side portion and the power side portion are separated by insulating couplers.
- 73. (Currently Amended) An integrated circuit (IC) package as claimed in claim 72 wherein the insulating couplers aid in the structural integrity of the <u>frame</u> [[PGID]].
- 74. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 further comprising a spreader plate that couples the <u>frame</u> [[PGID]] and the die, wherein the <u>frame</u> [[PGID]] and the die are between the spreader plate and the substrate.
- 75. (Currently Amended) An integrated circuit (IC) package as claimed in claim 74 wherein the spreader plate and the <u>frame</u> [[PGID]] are integral.

- (Currently Amended) An integrated circuit (IC) package comprising: 76.
- a substrate having a die-side, wherein a die is disposed upon the die-side of the substrate;
- a power pod supplying power to the die; and
- a package stiffener disposed upon the die-side of the substrate, and spaced from the die to deliver low-inductance current to the die, via the substrate, while concurrently providing stiffening support to the substrate, wherein the package stiffener electrically couples the power
- pod and the substrate and includes a capacitor.
- (Previously Presented) An integrated circuit (IC) package as claimed in claim 1 77. wherein the package stiffener includes a plurality of cooling fins.
- 78. (Previously Presented) An integrated circuit (IC) package as claimed in claim 1 wherein the package stiffener includes a capacitor.
- 79. (Previously Presented) An integrated circuit (IC) package as claimed in claim 78 wherein the capacitor includes an insulator.
- 80. (Previously Presented) An integrated circuit (IC) package as claimed in claim 1 wherein the package stiffener includes at least one of a plurality of power ground sections and a plurality of insulating couplers.
- 81. (Previously Presented) An integrated circuit (IC) package as claimed in claim 1 wherein the package stiffener includes a ground path from the die to the substrate.
- 82. (Previously Presented) An integrated circuit (IC) package as claimed in claim 1 wherein the package stiffener includes a rectangular frame.
- 83. (Previously Presented) An integrated circuit (IC) package as claimed in claim 1 wherein the package stiffener includes a rounded frame.

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84. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the frame [[PGID]] includes a capacitor.

- 85. (Previously Presented) An integrated circuit (IC) package as claimed in claim 84 wherein the capacitor includes an insulator.
- 86. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the frame [[PGID]] includes a plurality of cooling fins.
- 87. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the <u>frame</u> [[PGID]] includes at least one of a plurality of power ground sections and a plurality of insulating couplers.
- 88. (Currently Amended) An integrated circuit (IC) package as claimed in claim 63 wherein the frame [[PGID]] includes a ground path from the die to the substrate.
- 89. (Previously Presented) An integrated circuit (IC) package as claimed in claim 76 further comprising a plurality of power pods supplying power to the die.
  - 90. (Cancelled)
- 91. (New) An integrated circuit (IC) package as claimed in claim 76 wherein the capacitor includes an insulator.